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NUCLEAR DEVELOPMENT AND PROLIFERATION

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AEC CHAIRMAN DESCRIBES NUCLEAR RESEARCH IN BANGLADESH

Dacca THE BANGLADESH OBSERVER in English 26 Mar 81 Supplement pp 1, 3

[Article by Dr Anwar Hossain, chairman, Bangladesh Atomic Energy Commission]

[Text]

IT can hardly be over emphasised that science & technology is essential for speedy development of the country and attaining self-reliance. Science is not merely a knowledge and technology is not merely a tool but they are closely inter-related and required in improving the quantity & quality of production. Half of the national income of a developed country today is attributable to the elements of innovation—a product of science and technology activities. We must make better use of our resources, if necessary, by such transfer of such technology as can be adapted in our country.

Most of the developing countries are poor mainly because of primitive or out-dated techniques for production, poor exploitation of both human and natural resources and high rate of population growth. The lot of the country, including Bangladesh, can only be improved by massive use of science and technology.

Throughout the world, nuclear research is playing a vital role in various sectors of development. There is not a single aspect in the field of agriculture, industry, medicine, hydrology and power technology which does not fall under the purview of atomic energy.

Though the nuclear power programme is coming under increasing attack in the industrialised states they are going ahead with their plans and programmes while for many developing countries short of fossil fuel reserves, nuclear energy is simply a matter of survival.

Nuclear techniques are comparatively cheaper since the results could be faster and more accurate. Moreover, atomic research has a tremendous fall-out effect and leads to the development of modern technology, especially materials science, electronics and computer science.

In Bangladesh, the scientific community is small, and equipment and other facilities are scarce. Scientific research and development programme should thus be carefully planned and executed. It should also remembered that unless a critical size of scientists and facility are available meaningful results could not be expected. Once the infrastructure for scientific research has been laid, goal-oriented research will be started leading to extension or pilot plant work. Research to production needs a leadtime which must be given to the scientists (along with men and materials) before they are asked to show results.

Despite many difficulties, handicaps and limited resources, Bangladesh Atomic Energy Commission has been making steady scientific endeavours to lay the foundation of applied research using nuclear techniques. Some of the contributions made so far by the BAEC in the various sectors (this is only indicative of the wide range of nuclear research programmes that can be taken up) are listed below:

FOOD & AGRICULTURE

By using gamma radiation from Cobalt 60 sources, BAEC has developed some high yielding, early maturing and disease resistant varieties of rice. Two of these varieties have been named as IRRATOM—24 and IRRATOM—38, whose per acre yield have been shown to be as high as 100 maunds. These varieties which have been recognised as national varieties and well accepted by the farmers are being cultivated all over the country.

High yielding and early maturing varieties of jute having better fibre quality has been developed by the BAEC using gamma radiation. One such established variety is ATOMPAT-38; two other varieties ATOMPAT-39 and ATOMPAT-60 are in the final stages of investigation. These varieties will certainly boost the (agricultural) production of jute in the country.

Pulses being poor-man's protein, attempts have been made to develop high-protein varieties of pulses. Already using gamma-radiation a high protein variety of gram named Hyprosola has been developed.

The BAEC evolved an isotope techniques and has made definite fertiliser recommendations for rice, jute and sugar cane. These recommendations which include the specific combinations of the fertiliser NPK and also the time of application of the fertilisers are now being followed by Govt. farms and cultivators. Micronutrients (especially zinc) present in the soil in different parts of the country are being investigated in order to prepare a soil map of Bangladesh.

Bangladesh Atomic Energy Commission has been conducting research on the preservation of food items at very low dose by radiation. The results show that when treated by a dose of 0.08 to 0.10 Kilogray of radiation sprouting of onions and potatoes can be inhibited and then they may be preserved for a year at a room temperature i.e. around 15°C instead of 3°C to 7°C created in cold storage. This dose destroys spoilage and pathogenic micro-organisms in food; disinfects spoiling agents in grain and dried fish; extends shelf life of fresh fish viz. hilsha, carp, mackerel three fold & shrimps still more and tropical fruits like banana, mango and papaya. It also improves the wholesomeness of various foodstuffs etc.

Food preservation by radiation has added a new dimension to the methods of preventing food spoilage.

Treatment of food items by irradiation upto a dose of 10 Kilogray involves no loss of essential nutritional and sensory quality of consumable food items and leaves no harmful residue.

This clearance was given by the highest international Joint Expert Committee (JEFCI) consisting of IAEA, FAO & WHO recently.

HEALTH AND FAMILLY PLANNING

The Atomic Energy Medical Centres at Dacca, Rajshahi and Chittagong have been using radio-isotopes for diagnosis as well as therapy. Diseases of the thyroid gland, liver brain kidney spleen and blood etc are already being diagnosed at these centres. On an average 3000 to 4000 patients are being handled every year in Dacca, Rajshahi and Chittagong for diagnosis and treatment. The gamma cameras which are presently being installed in our medical centres are going to play a vital role in the furtherance of the cause of nuclear medicine in the country.

A successful implementation of the family planning programme in Bangladesh requires that the vasectomy kits which are being used be sterilised quickly. Already using the gamma radiation from Cobalt 60 source, batches of vasectomy kits are being sterilized for use in the family planning clinics. Radio-sterilization of medical and public health supplies and defence kits is also being done.

The radio activity present in our environment is being continuously monitored by measuring the radioactivity in soil, vegetables, water, air etc. This programme has been very useful for investigating ways of reducing uptake of radioactivity into the human body in view of continued atomic blasts elsewhere.

INDUSTRY

X-ray and gamma-ray radiography techniques have been developed to test the weld quality of pipeline joints, pressure vessels, boilers, locomotives, ship vessels, bridges towers etc. Already valuable services in the field of industrial application of radioisotopes have been rendered to various national organizations like Siddhirganj Power Plants, Bangladesh Air-Force, Eastern Refinery Ltd. General Electric Manufacturing Plant, Chittagong, Omar Brass (Bangladesh) Ltd. Gearman & Engineers Ltd Progoti Karigar Ltd. etc.

HYDROLOGY

Radioisotope techniques have been developed for the study of ground water recharge in the North Bengal. The quantities of interest here are ground-water velocity (1-10 ft. per day) and the quantum of water in a given region. The Laboratory scale studies in this direction have been mostly completed. Field use is awaiting.

EXPLORATION OF BEACH MINERALS

Exploration of the valuable heavy minerals like zircon, rutile, ilmenite etc. in the beach sands of Cox's Bazar and the offshore islands has been a continuous process. Already the physical and chemical methods for analysis of beach sand minerals have been developed. A pilot plant has been established in Cox's Bazar to determine the flow-sheet for separation of the minerals on a commercial scale. The exploration and survey conducted so far indicate deposits of zircon (1 lakh 41 thousand tons), Rutile (57 thousand tons), Monazite (17 thousand tons), Ilmenite (9 lakh tons). The present estimated value of the deposits is about 80 million US dollar. Further survey could enhance these figures.

Arrangements are now being made for commercial exploitation of these minerals.

URANIUM AND THORIUM EXPLORATION

Some anomalies have been observed which indicate the presence of Uranium and Thorium in Sylhet and Chittagong. Further survey and field investigations are under progress. A Geochemical laboratory is now planned to be set up to make geochemical analysis for determination of locations for drilling in order to find out the extent of deposits and their economic stability.

ELECTRONICS

Besides performing repair and maintenance work, the BAEC has designed and fabricated 27 different electronic equipment which are being used in a number of organizations including the educational institutes. The electronics personnel of BAEC have been rendering repair and maintenance services to national organisations like DMCH Diabetic Association, IPGMR Hydraulic Research Laboratory, Dacca University, etc. the BAEC has already conducted a market survey for use of electronic equipment and is orienting its electronics programme accordingly.

BASIC RESEARCH

There are two kinds of basic researches in which BAEC scientists are engaged:

In the first kind, scientists pursue basic research as a prerequisite for applied research in a goal-oriented scheme. Using a method called [illegible] would consider whether to proton-induced X-ray emission (PIXE), a quantitative estimation of comparatively heavy elements in agricultural and industrial products help determine the quality of the products and also the health hazard elements in trace amounts in a number of local samples including beach sand minerals.

uranium field samples pulses jute fibre etc. have been studied using this method of quantitative estimation.

In the second category of basic research a small fraction of the BARC scientists are pursuing some front-line problems in nuclear sciences and solid states physics which pose some very basic questions and thus preserve the evergrowing interest in science.

The basic research of the BARC has demonstrated its importance to education by collaboration with universities, imparting basic & technical training.

FUTURE ACTIVITIES

Savar Project: The BARC wants to continue the peaceful uses of atomic energy as mentioned above.

It is expanding its R & D Programme at Savar where the major central facilities will be a research reactor, a strong gamma source and a fast computer. The activities centred around the research reactor would be to produce isotopes, to provide a better base for training and research in the nuclear sciences and to acquire the technological know-how of power reactors and associated facilities.

Power Reactor: The urgency of the Rooppur Power Reactor in North Bengal has been felt and attempt has been made to implement the project. The matter is under active consideration of the Govt. and it is hoped that the project will implemented early.

CSO: 5100/7080

DISPUTE WITH UNITED STATES OVER NUCLEAR WASTE REPROCESSING

Kuala Lumpur BUSINESS TIMES in English 25 Mar 81 p 15

[Article by Prakash Chandra in New Delhi]

[Text] INDIA and the US are heading toward a collision course on the crucial issue of reprocessing of waste fuel from the American-built Tarapur power reactor.

A reprocessing plant near the reactor, built at a cost of more than US$130 million, has been lying idle for several years now. American officials invoke the 1963 agreement with India on Tarapur and would not permit the reprocessing of the highly radioactive waste material.

Now, hundreds of tons of such material are being stored in water tanks, in glass cases which could be a hazard to the entire region, although very elaborate precautions have been taken by nuclear scientists.

But the question at issue now is the phrase "joint determination" as contained in the Indo-American agreement on Tarapur.

Americans say that it gives them some sort of a "veto power" over the use of the Tarapur plant which cannot be activated unless there is "joint determination" by officials in New Delhi and Washington.

But New Delhi has argued that the situation has considerably changed with the signing of another agreement in 1971 between India and the US with the International Atomic Energy on imposition of safeguards on Tarapur and the reprocessing plant.

Indian experts told Depthnews that the safeguarded material — the waste fuel from Tarapur reactor — can now be reprocessed at the plant without such "joint determination."

Behind this phrase a great deal of diplomatic bickering is going on. American newspapers have accused India of waging nuclear blackmail against the US. This happened after a team of American reporters visited Indian nuclear installations at Trombay and the headquarters of the Department of Atomic Energy.

Stories filed by American correspondents stated that India was on the point of renouncing the Indo-American nuclear agreement and starting the reprocessing plant."

An official statement in New Delhi sharply denied these allegations but maintained that the product of the Tarapore reactor was Indian property and since it was "safeguarded," Indian nuclear officials had the liberty to reprocess it.

This is disputed by Washington. And it has triggered off what looks like a war of words between the two capitals. And it threatens to engulf the entire range of Indo-American relations.

For, President Reagan's advisers are taking this issue seriously because of Pakistan's efforts to build an Islamic bomb.

Somehow, American officials tend to believe that India is keen to start the reprocessing mill to convert the radioactive waste material into plutonium. This will enable the country to stockpile weapon-grade material for launching a new series of nuclear explosions, so the US argument goes.

This has been sharply rebutted by nuclear policy-makers like Dr Homi Sethna and Dr Raja Ramanna, secretary of the Department of Atomic Energy.

New Delhi has just set aside 2,000 million rupees (US$248 million) for stepping up research and development activities of the Department of Atomic Energy which, in effect, means that if a decision is taken to reactivise the plant at Trombay, some of the money would come handy.

A senior official told Depthnews: "India needs plutonium badly because its entire future planning for fast-breeder reactors is based on plutonium. These reactors produce more energy than the fuel they use which consists of natural uranium (that is abundant in this country) and plutonium."

French officials have pledged assistance to India's planning of fast-breeders. A fast-breeder reactor already coming up with French assistance at Kalpakkam, near Madras.

On the diplomatic front, there is growing fear that American officials are wary of giving any encouragement to the Indian side. They believe that India, already an unofficial member of the Nuclear Club, may go ahead with nuclear technology and rival the Great Powers in this highly sophisticated and sensitive area.

Indian policy planning experts believe that the Reagan Administration has started on a false trail of mistrust from the word go. For, the nuclear question tends to becloud the entire range of Indo-American relations.

What is stoking the nuclear controversy is the reluctance of the Reagan Administration to provide shipments of fuel to India which have already been delayed.

There is a considerable degree of uncertainty about the whole question. What the Americans want is the application of "full-scope" safeguards to India's nuclear industry.

This means application of tightly-organised system of safe guards to the present, past and future nuclear reactor which are all designed for power production.

This means application of tightly-organised system of safeguards to the present, past and future nuclear reactors which are all designed for power production.

The Indian argument is that the Americans cannot apply these safeguards to a peaceful country like India or any Third World country when the Great Powers themselves are engaged in the task of perfecting more deadly nuclear missiles and a whole range of weapons.

At the heart of the controversy is the question of sovereignty. The real issue at stake is: To whom does the nuclear waste material belong?

The Department of Nuclear Energy has explained the entire situation in the form of questions and answers. A copy of this was obtained exclusively by Depthnews.

■ Q. Given the negative public reaction in the US, doesn't India appreciate the efforts made by the US administration to continue fuel shipments for Tarapur?

■ A. It has to be borne in mind that Tarapur is a commercial utility supplying power at competitive rates to consumers in India. It would be unfortunate if its functioning were dependent on considerations such as the geopolitical situation in the area as perceived at a given time by one of the parties to the agreement or on the basis of India's relations with other friendly countries.

Though we can appreciate that in a democracy, various individuals and organisations are entitled to expressing their views freely, it is becoming increasingly difficult for the government of India not to rebutt various false allegations and distorted statements of Tarapur which are being given wide publicity in the Western media.

■ Q. What would be India's reaction if Pakistan explodes a nuclear device?

■ A. We sincerely hope that the government of Pakistan will abide by its pronouncements. However, should there be evidence of Pakistan acquiring nuclear weapons, then that would introduce a new factor which will have to be taken into account in the formulation of our policies. The Prime Minister has said that the acquisition of nuclear weapons is not necessarily the best way of ensuring a country's security.

■ Q. In view of the adverse impact of delayed supplies, why has India not regarded the agreement as terminated?

■ A. India has already brought to the notice of the US government that persistent and unwarranted delays in fuel shipments have adversely affected the functioning of the Tarapur station, thus frustrating the basic object and purpose of the 1963 agreement.

India is also quite clear it would be unable to accept a situation where delays and uncertainties become a permanent feature of the Indo-US nuclear cooperation. India has exercised a great deal of patience but its condonation of earlier delays does not mean the acceptance of similar delays in the future.

■ Q. Why is India threatening to reprocess the accumulated spent fuel at Tarapur and blackmailing the US in this regard?

■ A. The failure of the US to respond to our requests for the completion of the "joint determination" exercise has forced India to pay economic penalties. Extensive modifications had to be carried out for augmenting the storage facility for spent fuel at considerable expense and preventing a closure of the Tarapur plant.

The reprocessing plant, which was constructed at considerable expense, has not yet been used for the purposes for which it was built, though it was set up with the full knowledge of the US authorities. Though India has shown considerable restraint on this aspect of US non-performance of its treaty obligations, it does not intend to indefinitely allow the situation to continue.

■ Q. How have problems arisen with regard to the 1963 Agreement?

■ A. In April 1987, the US Non-Proliferation Act came into effect as public law in the US. Under this law, applications for enriched uranium by a non-nuclear weapon state, such as India, cannot be entertained after September 1979, nor can any application be considered unless the recipient country agrees to place all its peaceful nuclear activities, irrespective of origin, under perpetual IAEC (International Atomic Energy Commission) safeguards.

The US domestic law contains a provision for exemptions to the application of this "full-scope safeguards" criterion, on a case-by-case basis, by the US President. Such presidential decisions can, however, be overruled by a simple majority in both Houses of the US Congress.

We have made it clear to the US Government that India will not accept the retroactive application of the US domestic law to the existing intergovernmental agreement, which enjoys the force of a treaty. — Depthnews

CSO: 5100

PROTON DECAY EXPERIMENT CONDUCTED INSIDE MINE

Calcutta THE STATESMAN in English 4 Apr 81 p 11

[Text] NEW DELHI, April 3—Indian and Japanese physicists have launched a massive hunt for a rare nuclear event in a unique experiment deep inside the Kolar gold mines, reports PTI.

The hunt, if successful, will lead to dramatic changes in the theories of physics and cosmology.

A team of scientists of the Tata Institute of Fundamental Research in Bombay and four senior physicists of two Japanese universities have set up the experiment inside the mines 2,300 metres below the surface.

TIFR scientists said such a deep location was essential to block out the cosmic rays that might otherwise interfere with the detection of the most elusive nuclear event.

The heart of the experiment is a huge body of iron the size of an average bedroom. Inside this iron "detector" the scientists are looking for a hitherto unobserved nuclear phenomenon: the decay of a proton.

The phenomenon is said to be so rare that only about 10 such events are expected to be detected in two years of experiment at the mines.

Protons are basic constituents of all matter and they were always thought to be the stablest particles of nature.

But the experiment at the mines is going to verify a startling theory that protons may actually split into smaller particles, violating one of the basic conceptions in physics.

Such a finding will be a breakthrough in physics. It will revolutionise theories of cosmology, pave the way for the unification of nature's forces, and may also explain why the universe evolved with an excess of matter over anti-matter, scientists said.

The prediction that protons may decay was made in 1973 by the Pakistani Nobel laureate, Professor Abdus Salam, and an Indian physicist, Mr Jogesh Pati, now working at the University of Maryland in the USA.

Proton decay has so far eluded verification because the event is extremely rare and there are not many places where the experiment can be carried out.

Scientists have estimated that a single proton will take 100,000 billion billion billion years to decay.

Such a rare event cannot be observed on the ground because it can be masked by similar events caused by the millions of cosmic ray particles bombarding the earth all the time.

Indian and Japanese scientists got around the problem by setting up their detector system in the mines and using the earth above to block almost all the cosmic ray particles.

In order to increase the chances of detecting a proton decay, the scientists are using massive amounts of iron.

One atom of iron has 26 protons. At the experiment, 150 tonnes of iron are being used providing a source of 80,000 billion billion billion protons, at least six of which are expected to decay in a year.

The Kolar gold mines are the third site in the world where experiments are on to detect proton decay. Two groups in the USA are looking for proton decay in abandoned salt mines 600 metres deep.

CSO: 5100/7076

INDIA

BRIEFS

NUCLEAR POWER CAPACITY--Subject to availability of financial resources and basic inputs, India hopes to achieve a nuclear power generation capacity of 10,000 MW by 2000 AD, reports PTI. Prime Minister Indira Gandhi told Mr Balasaheb Vikhe Patil, in a written reply in the Lok Sabha on Wednesday that the programme would consist of a number of different projects. The cost of each would be worked out at the appropriate time, she added. Mrs Gandhi told Mr B V Desai in a separate reply that the cost escalation of the three nuclear power projects--RAPP, MAPP and NAPP--would not delay the completion of the projects. Their revised estimates had been approved and funds provided, she added. Cost escalation in respect of each of these projects is: RAPP--Rs 80.51 crore, MAPP--Rs 78.48 crore, and NAPP--Rs 166.11 crore, of which increase in prices of equipment--both imported and indigenous--accounted for Rs 49.61 crore, Rs 64.30 crore and Rs 119.83 crore respectively she added. Mrs Gandhi told Mr Janardhana Poojary that the Government proposes to start work on the setting up of a new atomic power station in the western region during 1981-82. The Prime Minister told Dr Vasant Kumar Pandit in yet another reply that the Government has a proposal to start construction of three nuclear power stations with two units of 235 MWE capacity each and three more heavy water plants during the Sixth Plan period. These will add 1410 MWE to the power generating capacity, she added. [Text] [New Delhi PATRIOT in English 2 Apr 81 p 5]

SUPPORT FOR H-BOMB--New Delhi, April 4--Mr. Krishan Kant, member of the national executive of the Janata party, today demanded that India must decide to prepare for a hydrogen explosion in the shortest possible time. In a statement, he said that India had "woefully slipped" in its peaceful nuclear programme after Pokhran. Once ahead of China in nuclear science, India has now been left far behind. The U.S. decision to help Pakistan go nuclear has made a sea change in the security environment of the region as a whole. Mr. Krishan Kant said that India's concerns arise out of current realities. "Pakistan is an unstable state having a regime whose legitimacy is being questioned increasingly within Pakistan itself," he pointed out. The impact of massive arms supplies and the prospect of Pakistan acquiring nuclear weapon capacity "is too serious to be wished away." [Text] [Bombay THE TIMES OF INDIA in English 5 Apr 81 p 9]

CSO: 5100/7077

SOUTH KOREA

FRENCH-SOUTH KOREA NUCLEAR COOPERATION NOTED

Paris LE MONDE in French 2 Apr 81 p 6

[Article by R.-P. Paringaux--passages enclosed in slantlines printed in italics]

[Text] Seoul--Awaited since November 1979 but delayed because of the political and military events that shook South Korea in 1980 after the assassination of President Park Chung-hee, Mr Francois-Poncet's trip to Seoul, which started on Monday, 1 April, would a year and a half ago have been no more than a routine visit as part of the French Government's policy of /"economic diplomacy."/ Because of political changes in South Korea, on the one hand, and because of a breakthrough by FRAMATOME [Franco-American Atomic Construction Company] in the meantime, on the other hand, this visit now partakes of both nuclear and political cooperation with a regime whose repressive methods have been the object of considerable criticism.

Nevertheless, its international image has been improved by the commutation of the death sentence decreed against Mr Kim Dae-jung, the opposition leader, by the abandonment of martial law, by the spectacular reversal in American policy toward President Chon (LE MONDE of 4 February) and, finally, by the formal holding of presidential and legislative elections tightly controlled by the regime. A French diplomat thus describes the situation of /"conditional freedom"/ that prevails 1 month after the establishment of the fifth republic: /"South Korea now is being sent to get schooling in democracy, and it is starting with kindergarten."/ So it is to a country where military order is supreme again under a civilian cloak that the first French foreign minister to pay an official visit to South Korea will arrive, after various vicissitudes. He was to have met President Park, now he will see President Chon. He was to sign an economic cooperation agreement, now, above all, he will sign a scientific and technological agreement guaranteeing the peaceful utilization of nuclear installations, or, in other words, a non-proliferation agreement.

The postponements of this visit were the result of the tragic events that have marked this /"country of the peaceful morning"/ for 18 months, bringing bloodshed and economic weakness. It was scheduled for November 1979, but the assassination of President Park a month earlier made it impossible. Then it was contemplated for October 1980, but the Kim Dae-jung affair, the passion that it aroused in some sectors of the international community, the critical attitude of President Carter, and of Japan, with regard to Seoul, would have made it politically risky. Then there came a new postponement, which Korean officials maintain they /"understand,"/ considering the /"political confusion."/ Nevertheless, it was maintained elsewhere that they did take offense and the nuclear contract might suffer for it. Mr Cointat, minister of foreign trade, was then sent to Seoul to provide reassurances.

It was at the time of that visit, according to good sources, that the contracts, which had been long in negotiation, were finally given to FRAMATOME and COGEMA [Nuclear Materials General Company] at the expense of the American firm Westinghouse. They still needed to be guaranteed, in order for the work to begin. It is Mr Francois-Poncet himself who will provide this. Resting on this are, in the first stage, FRAMATOME's assembly of the two nuclear islets (reactors), and in the second, COGEMA's contract to supply the fuel (enriched uranium) for 10 years.

The two contracts total a sum of Fr6 billion. They are financed by a purchaser loan with an interest rate of 7.6 percent, with repayment stretched over 15 years and a 7-year grace period.

One can imagine the importance France attaches to the deal and to the prospects for future cooperation which it makes possible to consider in a field where the Americans retain the lion's share, which they intend to keep and increase.

A 'Second Japan?'

The fact that the French minister takes the trouble to make this move right in the middle of the election campaign--which is unusual--seems to confirm its importance. Another factor which seems to have also worked in favor of the trip at this time is the visit made by Mr Francois Mitterrand to the other Korea, North Korea, in February.

This being the case, some people regret that the official visit did not take place earlier, as scheduled. In fact, what could have appeared to the South Koreans, isolated and exposed to a storm of criticism, as a bold political gesture on the part of Paris no longer has the same character after the about-face of the United States, the warm welcome given to President Chun in Washington, and consequently, the thawing of relations with Tokyo.

Nevertheless, French circles in Seoul are hoping that their foreign affairs minister's visit /"will mark a change of pace in economic and commercial relations."/ Indeed, here as in Japan and ever elsewhere in Asia, France is lagging behind. It is about tenth in line, after the EEC, Great Britain and Holland, for bilateral discussions.

However, French firms are in the running for some big development projects: a new steel-making complex, the Seoul and Pusan subways, a tide-driven factory, port improvements. Some official circles seem to think: /"Korea will be a second Japan; let us not miss the boat."/ /"South Korea,"/ says one of them, /"is a less dangerous partner than Tokyo and has chances Taiwan lacks to gain access to the Chinese market, the West Coast of the United States and Southeast Asia."/

Others, more reserved, especially after 1980, when growth was negative (5.7 percent down), stress a vulnerability due as much to the geopolitical context as to /"an economic and social fragility."/

Which does not mean, they add, that the French should not make efforts. On the South Korean side, in addition to the chance the visit will present--which will not be wasted on them--to enhance the new regime's international prestige, it appears that two basic benefits are expected. The first, which concerns nuclear cooperation, is an inflow of technology and facilities to obtain enriched uranium, two points on which the Americans, at least under President Carter, showed themselves to be quite reluctant to yield, out of fear of proliferation. It is for that reason--as well as to diversify sources of supply--that the contracts were given to the French, and not, according to officials, because of their competitiveness.

The second benefit is diplomatic. It concerns, we were told by a high-ranking foreign affairs official, /"the political support that France could obtain in Africa for our position in our confrontation with North Korea."/

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CSO: 5100/4534

INSTRUMENT FOR MEASURING NUCLEAR FUEL IN CASSETTES DEVELOPED

Sofia OTECHESTVEN FRONT in Bulgarian 17 Apr 81 p 3

[Article by Rumen Zografski]

[Text] Nuclear fuel in atomic power stations is stored in special cassettes. Sometimes unutilized fuel remains in those cassettes. Hitherto there was no industrial method for determining the level of the consumed fuel, despite the great economic significance of this valuable primary material. The way in which one could determine whether a cassette was still suitable for service was based on the length of time that a reactor was in operation.

Bulgarian scientific workers and specialists at the Institute for Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences have created a precise gamma-spectrometric method for measuring the depth of burning in the fuel cassettes of the reactor. In the basin in which the cassettes are stored the specialists installed a special device which radiates gamma rays. These same gamma rays which pass through the cassettes are registered by semiconductor detectors. The difference in the spectral lines determines the amount of the fuel that has been consumed. Thus, with the new device it is possible to establish whether a given cassette should be left in an active zone in order to use up the fuel left in it.

The scientific work in this sphere is of great interest not only because it concerns the economics of nuclear fuel but, also, because it offers the opportunity to select the best refueling rate of the reactor. The new device was successfully tested under operational conditions. One can say that the problem has been resolved. The accuracy of the measurements made with the cassettes at the "Kozloduy" atomic power station is equal in its precision to that achieved only in the large atomic centers.

CSO: 5100/3015

BRIEFS

FOURTH ATOMIC REACTOR ARRIVES--The fourth water-water reactor with a 440 megawatt capacity, weighing 200 tons, has been unloaded near the construction site of the Atomic Energy Complex at Kozloduy on the Danube River. The shipment also includes three steam generators, generators, transformers, and cylinders for the seventh and eighth turbogroups. [Sofia RABOTNICHESKO DELO in Bulgarian 11 Apr 81 p 2]

NEW ATOMIC POWER STATION--On 3 April 1981, issue No 27 of DURZHAVEN VESTNIK published Decree No 9 of the Council of Ministers pursuant to the approval of a construction site for the second atomic power station--"Belene-East." In order to obtain more detailed information on the subject we called on engineer Stanka Kosharova, chief specialist for atomic energy at the Ministry of Energy, who said the following: "In accordance with the general agreement for cooperation and the long-range development of the unified power systems of countries belonging to CEMA during the 1981-1990 period, for the last several years a group of specialists, including Soviet specialists, has been working on the selection of a site for the construction of a second atomic power station in Bulgaria. It was decided that the most suitable site for the purpose is the eastern area of Belene town in Pleven Okrug. It is planned to carry out in stages the construction of blocs for 'VVER-1000' reactors whose capacity is 1,000 megawatts. These reactors are the second generation of the 'VVER-440' reactors installed at the Kozloduy Atomic Power Station as well as those installed in atomic stations which have been built or are now being built in Czechoslovakia, the GDR, the USSR and Hungary. The first two reactors of the new type will be installed for the first time outside the Soviet Union at the Kozloduy Atomic Power Station. The selection of the site takes into consideration the possibility of building an atomic power station with a capacity in the 4,000 megawatt range. The construction is expected to start at the end of the eighth five-year plan. An international agreement for the extension of technical assistance in the planning and construction of the project will be signed with the Soviet Union. During the current year the necessary plans and measures associated with the construction site will be developed." [Text] [Sofia ZEMEDELSKO ZNAME in Bulgarian 7 Apr 81 p 3]

CSO: 5100/3016

CNEA STUDY STRESSES IMPORTANCE OF NUCLEAR POWER

PY272007 Buenos Aires TELAM in Spanish 1930 GMT 26 Apr 81

[Text] Lima, 25 Apr [as received] (TELAM)--Nuclear energy will produce half of the electricity consumed throughout the world toward the end of this century, since its potential is greater than petroleum, coal and natural gas reserves put together. This is revealed in a study carried out by the Argentine National Atomic Energy Commission [CNEA]. It adds that thanks to the work of scientists, man can today make use of the nuclear resource, exploiting the energy released by the nucleus of the atom.

The study warns that fossil fuel is reaching the point of exhaustion and science is, therefore, seeking the use of other sources such as a geothermal which comes from the heat released by the surface of the earth, as well as those of solar or oceanic origin. Nuclear energy, however, since it does not cause pollution, is the most usable source of the future.

The study adds that in 1955, overall energy production in the world amounted to 26 billion kilowatts per year, and in the 1970's it surpassed 50 billion kw, being expected to triple by the year 2,000, while the nuclear electric capacity during the same period increased 300,000 times, with predictions that by the end of this century 50 percent of the total energy will be by nuclear electric capacity alone.

The reason for this growth is economic in nature since in industrialized countries the electric energy produced in large nuclear plants is cheaper than any other source.

For example, says the study, the complete fission of only 1 kg of uranium releases an amount of heat equivalent to the combustion of 3,000 tons of coal, while the heavy hydrogen extracted from the oceans could produce huge amounts of energy.

It adds that in most developing countries, overall demand for electricity, although experiencing rapid growth, is still very small. In a modest electrical system, the maximum capacity of each classical or nuclear unit it still limited, due to technical and economic reasons.

Explaining the importance of uranium reserves as an incalculable potential for fueling nuclear reactors, it maintains that with the development of research we will reach a point where mankind will no longer worry about the lack of energy resources.

The study explains that this kind of reactors is built and exploited with the best of precautions to avoid accidents or loss of control, due to which man should not be afraid of progress.

The document adds, however, that fossil resources would not be lost since they will always be indispensable in manufacturing plastic products, medicine and new kinds of fuels.

CSO: 5100/2147

BRAZIL

REPORTER VISITS NUCLEAR POWERPLANT, DESCRIBES TEST OPERATION

Rio de Janeiro MANCHETE in Portuguese 28 Mar 81 pp 72-78

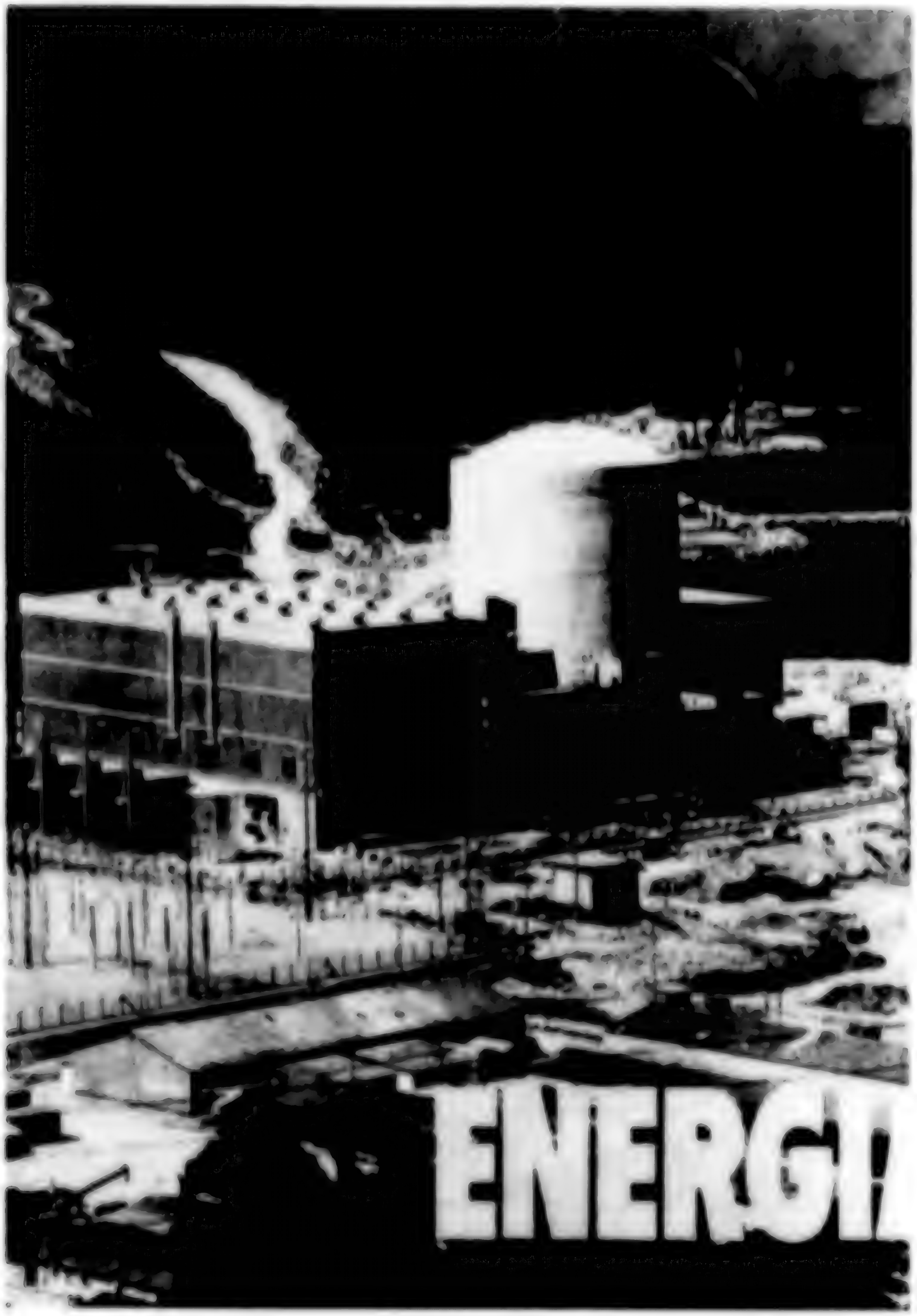
[Article by Irineu Guimaraes and Juvenil de Souza: "Nuclear Power"]

[Text] There is a contagious excitement in the control room of the Angra I nuclear powerplant. Thousands of colored lights blink unceasingly on the electronic panels which go up the walls in a delirious geometry as if they were tiny stars fighting in a nightmarish firmament. The screens of the television monitors show columns of coded figures and messages, while from other strange machines meters of perforated tapes emerge amid an infernal racket of whistles, alarms and bellows from the loudspeakers. Small groups of technicians study schematics reproduced on enormous maps which they compare with smaller versions drawn in colorful books. Workers with helmets and overalls of different colors give the final touches to the soldering in that labyrinth of electrical wires. In a corner of the room the driver of the Communications Center smiles enchantedly. He has been at Angra I and this was the first time he managed to enter that sacred place in the disguise of a photographers helper. We are actually in a control room where the final tests are being made. Everyone shows he knows his role perfectly. American engineers and technicians exchange information with their Brazilian colleagues. The layman who has the privilege of witnessing these final preparations has the impression of being in the control room of a gigantic machine ready to take off at any moment. Practically everything is ready. Angra I can go into operation. All the operator has to do is to throw the lever which is going to release the source of neutrons into the core of the reactor. Brasil will then be entering definitively into the nuclear age.

Actually the reverse countdown has already begun.

However, authorities have not yet scheduled a starting date.

Begun in 1972, Angra I cost nearly $2 billion and its 78 basic pieces of equipment are absolutely ready. It is well to point out that all this equipment has already had a "hot test," according to the jargon of the engineers, exactly as if the powerplant were operating for effect. All that is lacking is the loading of the reactor and for the operator to put into action the release of neutrons in the core.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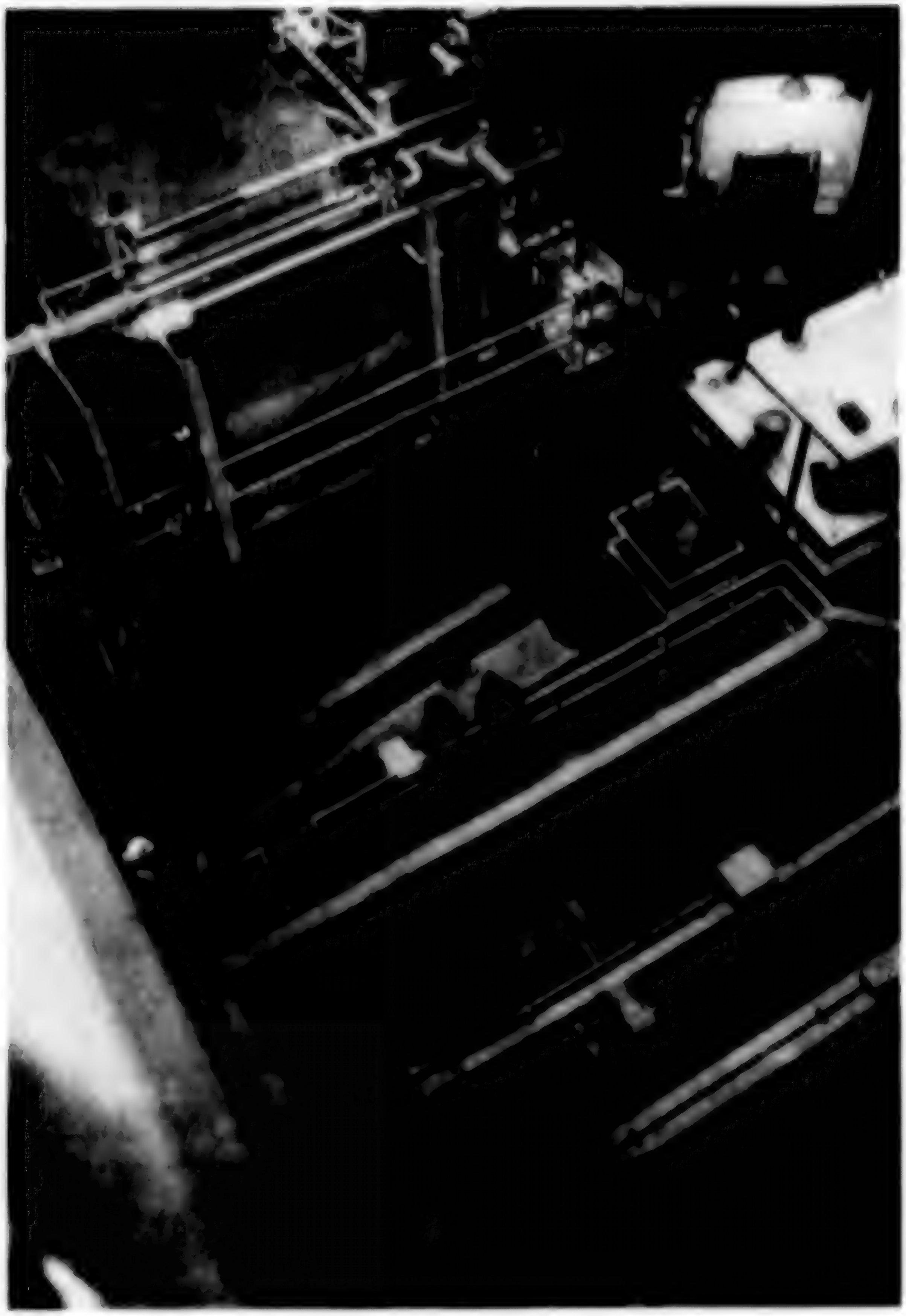


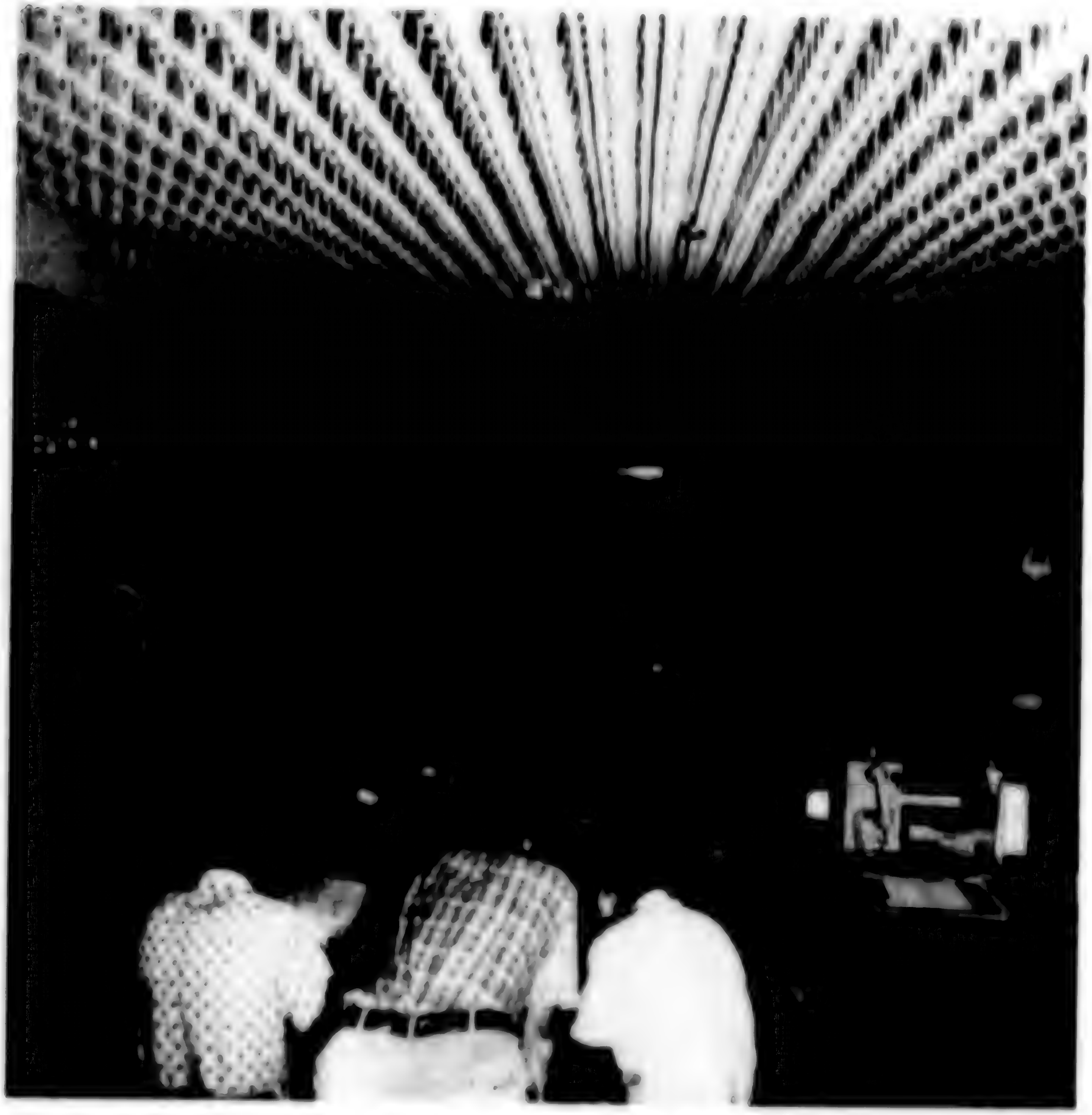
Preparations for beginning of operations are being completed in the reactor building.

Engineer Sergio Roberto Felicio Guimaraes, a Carioca of 38 years-of-age who was chosen by FURNAS [Brazilian Powerplants] to head the so-called Starting Group of the first Brazilian nuclear powerplant, explains certain contractual bureaucratic details. The construction of the Angra I powerplant was entrusted to the American firm Westinghouse Electric Company under a special contract system known as "turn-key." It is something like a customer ordering a car from a certain manufacturer who has the responsibility of delivering the completed vehicle in a perfect state of operation, requiring only the turning of the ignition key. However, it is obvious that the contract also stipulates the specialized training of a group of Brazilian technicians--precisely the Starting Group--who observe the installation of equipment, inspect the quality of the equipment and receives the suitable training from the manufacturer for their operation during whatever time is necessary. As far as Angra I is concerned, 210 technicians were trained in a total of 66 courses in various stages in Brazil and abroad. The more highly trained operators will receive training in the Westinghouse Nuclear Training Center (NTC) in Zion (United States) and FURNAS spent nearly $6,000 on each of them. The cost of training a nuclear "master" is $24,000 and a "doctor" cost the company around $100,000. Sergio Guimaraes knows his specialty well. And it is exactly because he knows it that he proclaims his absolute confidence in the starting team he leads. He knows that the inauguration of Angra I will have nothing particularly spectacular for the general public. Only the well-informed can evaluate the scope of an event such as that for a country such as Brazil.

To understand the technical-social-economic analysis of the engineer, it is necessary, therefore, before anything else, to know at least superficially what a nuclear powerplant is. It would be unfair at this point not to mention the effort made by the FURNAS Public Information Office to provide the public with an elementary but sufficient information. In the Angra I Communications Center there is an easily operated audiovisual panel which allows an almost instinctive understanding of that fictional universe.

In a somewhat naive way it can be said that a nuclear powerplant is a unit for producing electricity, which instead of using waterpower or ordinary fuels such petroleum and coal (conventional thermal electric plants), resorts to atomic fission for a source of heat. In that schematic for a classic nuclear powerplant, if we were to exclude the reactor, the rest would be practically identical to the circuits of a conventional thermoelectric powerplant. All the difference (and originality) resides, therefore, in the presence of the reactor. The literature in commonplace language prepared by FURNAS allows once to perceive with relative clarity what exactly a reactor is and the phenomenons that take place inside it.

Everyone knows that one of the elements of the atom, the neutron, when released collides with the nucleus of another atom producing the so-called nuclear fission. In other words, that released neutron, when it bombards the nucleus of another atom, splits it in two, releasing other neutrons, which in turn continue the bombardment in the interior of the mass of matter. What is called a "chain reaction" takes place, whose most noticeable and immediate effect is the production of heat. Scientists managed to come up with certain elements such as uranium

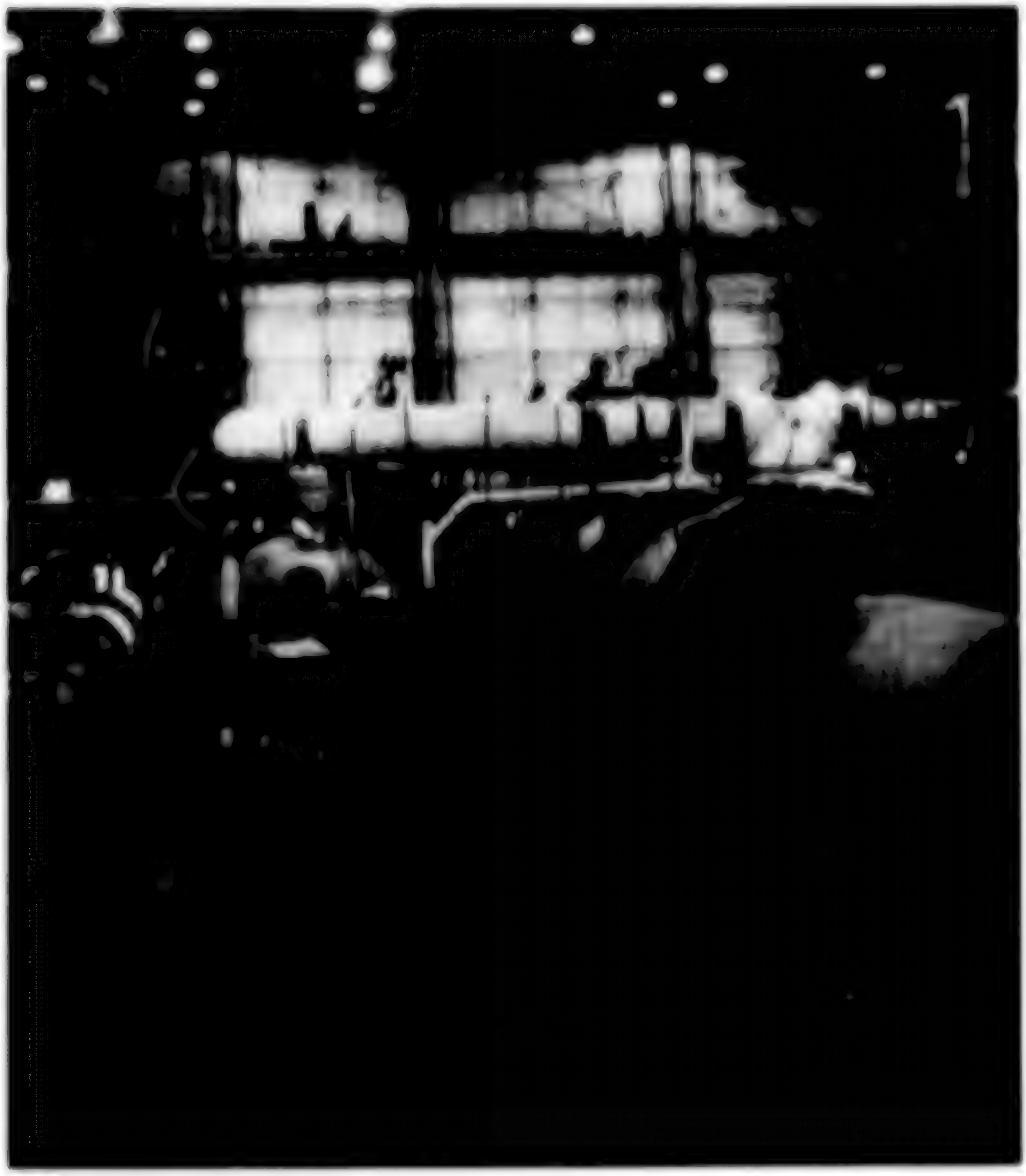


The control room is a gigantic cabin of electronic controls from which operators can activate any sector of the powerplant. Alarms insure absolute safety!

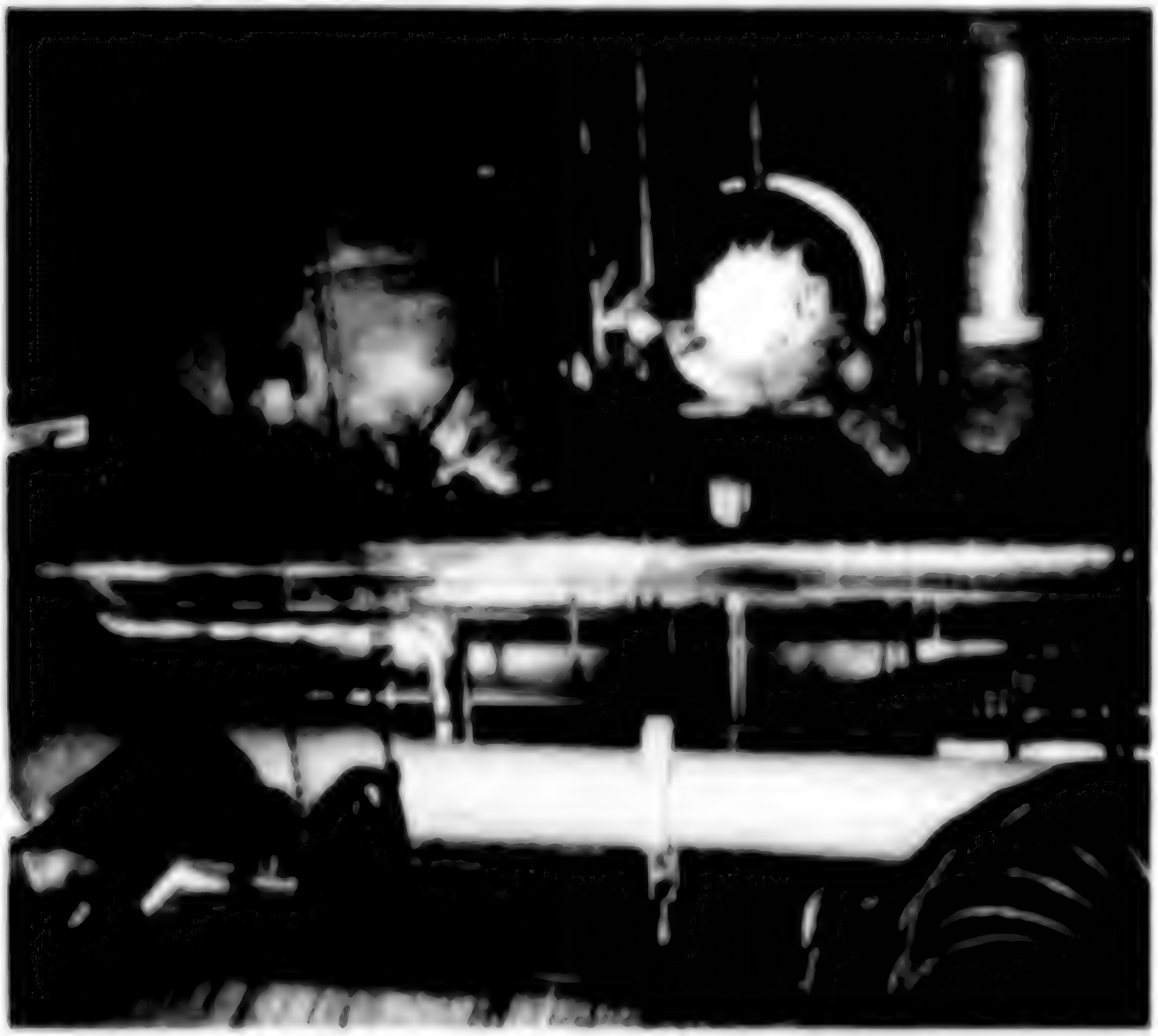
dioxide pellets, which contain only about three percent fissionable material. The rest consists of uranium which does not become fissionable inside the reactor. These pellets are precisely the fuel used in nuclear powerplants.

They produce unstable radioactive substances which emit radiations but which can be stabilized, losing, not all but at least a considerable part, of their radioactivity. The reactor, therefore, is a collection of great vessels in whose interior nuclear fission takes place. The innermost part of the reactor is the core, within which are introduced hollow rods of a special material containing certain quantities of uranium dioxide pellets, all of which together are called fuel elements. Together with those fuel elements, groups of special rods are inserted in the reactor core rods, which have the property of absorbing released neutrons. The proper handling of those rods is going to allow an absolutely rational control of the neutron population in the interior of the core, increasing or decreasing the rate of fission, which means the production of heat. The hollow rods of the Angra I reactor are nearly a centimeter in diameter and 3.65 meters long. The core receives a total of 256 hollow rods and 37 control rods. The total charge of fuel is 51 tons of uranium. All those elements are submerged in a special water called "light water," which is nothing more than water which has been purged of all mineral elements. It is, therefore, simply water, the famous $H^{2}O$ in an extremely pure state. The heat of nuclear fission brings this water to a temperature a little above 300 degrees Centigrade. To prevent this water from boiling, there is a pressurizer which maintains a pressure of 157 atmospheres. That is why the system used at Angra I is called the "light water pressurized" system, that is the PWR--Pressurized Water Reactor. It is the system most used in all countries which have nuclear powerplants. This water heated by nuclear fission, which naturally concludes by acquiring a relatively high degree of radioactivity, remains contained in a hermetically sealed circuit called the "primary circuit," without any direct contact with the water in any other circuit. The interior of the core is crossed by a collection of pipes through which another totally isolated water circuit passes, which is going to receive heat by indirect contact. This is called the "secondary circuit."

It is this water from the secondary circuit that is going to become steam to move the blades of the generator turbine which is totally outside the reactor. Subsequently,the steam is cooled in special condensers and once more becomes the water feeding the sealed secondary system. The water from this cooling circuit is pumped directly from the sea and is later returned through a tunnel, which is more than a kilometer long. When it reaches the ocean once more, the cooling water does not, under normal conditions, pose the slightest danger of radioactivity. However, its temperature is nearly seven to 12 degrees higher than the surrounding water. This is the only anomaly. Therefore, given the size of the liquid mass of the sea, the diffusion of that additional heat and its absorption does not present major problems. To have an idea of the collection of safety systems surrounding the reactor (where radioactivity takes place) it is worth recalling the diagram: the core (fuel elements, control rods and light water) are inside a completely armored pressure vessel which is 3.35 meters in diameter and 12 meters high. In addition to the pressure vessel, there is a larger one whose walls are three-centimeter thick steel plates which surround



All the electric power of Angra 1 will be generated by a single turbine or turbo-generator unit which weighs 1,670 tons. The turbine is moved by the steam formed in the pipes of the secondary circuit. The water of this second system has no direct contact with the radioactive water of the interior of the reactor core.



Another view of the turbine.

The cooling water system will empty into Piraquara de Fora Bay

Leader of the Starting Group, Engineer Sergio Guimaraes (center), and his associates Pedro Jose Diniz and Luiz Fernando.

Alceu Braga Lopes, powerplant construction director, does not hide his euphoria on the eve of the beginning of operations of the first unit. For him the important thing is the attainment of nuclear technology.

the entire unit. All this unit is inside a concrete building whose walls are 70 centimeters thick. It is the so-called reactor building, which is 58.23 meters high and 36 meters in diameter.

This is an extremely simplified description of the Angra I reactor. Other than this unit, the rest is conventional, but only up to a certain point. The requirements of safety and protection against radiation reach unimaginable heights. For example: All the steel used in the civil construction of the reactor and other sectors of the powerplant--and even the concrete--come from special runs duly recorded. All the welds are x-rayed and those x-rays stored in special files. The reactor building is installed pursuant to a system of special precautions stipulating the adoption of earthquake-proof buildings, which would allow withstanding earthquakes or shocks of a certain intensity. As far as precautions for the physical safety of the plant, equipment as well as personnel, the measures adopted are due to the fact that it is the most modern equipment in the world as far as electronic sentinels, alarms and so forth is concerned. Protection of the environment takes those in charge to extremes that could serve as models to other countries.

In the radio-ecology laboratory, for example, masters and doctors, who have studied specialized courses abroad, proceed to take minute readings of environmental radioactivity, water and air quality with supersophisticated instruments to detect the slightest abnormality. Elsewhere, all the controls in the control room are doubled, or as the engineers say in their own jargon, they are "redundant." This means that all control circuits are repeated, there being, therefore, not the slightest rational chance of accident or mistake. In the control cabin, the operator is notified of any unusual occurance and if there is a radioactivity leak alarm he can even stop the reactor immediately. Only complete ignorance can justify certain alarmist rumors such as the danger of a nuclear explosion or fatal contamination from extremely high radioactivity. There will not be any two-headed fish in Angra Bay or any monstruous plants. Permanent and total monitoring of the environment insures a constant watch 24 hours per day. For that very reason the Angra I technicians prefer to analyze the problem on the basis of more realistic angles. Engineer Sergio Guimaraes believes, for example, that certain types of campaigns against nuclear powerplants are perfectly understandable within the normal reactions of the human being. Actually, however, he believes that it is a false problem. It is obvious that the reflex of fear is obvious, first of all because it is a force of nature not yet completely mastered by science. Like all forces not entirely mastered, the nuclear has a sort of fascination, of fear in the conscious and unconscious mind of humanity. Moreover, the first contact civilization had with nuclear power was a catastrophe, almost the apocalypse. No one forgets Hiroshima and Nagasaki. Nuclear power became almost synonymous with the atomic bomb. This perverse association has irreversible effects, even among scientists of a high level and much more so among the ordinary mortal. However, it is a false problem because there is no choice. Sergio Guimaraes and his principal helpers, Pedro Jose Diniz and Luiz Fernando de Carvalho openly confess that the specific aspect of electrical power production by nuclear fission is very important but not essential. What is important for a country such as Brazil is the acquisition of a sophisticated technology which places it up to a certain point on an equal footing with the more developed countries. Nothing would justify a lag by Brazil in this area. Sooner or later we shall be obliged to move along that road. In this respect, the beginning of operations of Angra 1, marking the entry of Brasil into the nuclear age, is a decisive step. The country thus remains prepared to face the future with a certain tranquility. Also, remaining within the specific area of the nuclear powerplant, Sergio Guimaraes and his team believe that from the point of view of practical knowledge, there are certain important fundamental criteria besides electricity, among which are a) safety of man; b) safety of equipment; c) reliability of equipment; d) functioning of the equipment. All these items will have a different influence on the industrial mentality which will be entirely renovated in Brasil after the first nuclear powerplant goes into operation.

For Alceu Antonio Braga Lopes, the construction director for Angra 1, these observations by Sergio Guimaraes are more than pertinent. Originally a chemical engineer, Alceu Lopes, 50 years-of-age, a rabid soccer fan, a man with both feet on the ground, likes to refer to very down to earth examples to explain certain types of euphoric resistances. A realist, he says that in order to make a suitable response to the demand for electric power in the main industrial centers of Brazil after the year 2000 there is only the nuclear option. Already at this time, in the Rio-Sao Paulo axis, there are no new waterfalls that can be used. He says that the advantages of the nuclear powerplant are that it is flexible, easily handled and installed near the consumption centers. However these academic discussions are not very interesting and he, like Sergio Guimaraes, prefers to call attention to the change in mentality that the nuclear age is going to cause among businessmen. He cites convincing examples. Before nuclear energy there were no conditions existing in the country for even checking a simple pair of caliphers. That is not so now. The very entry of the community into a sophisticated era is going to force industry to improve its production of precision instruments, to insure a regular supply of components. We cannot depend on foreign countries for that type of an advance. Alceu Lopes take the opportunity to praise the philosophy of the nuclear agreement signed by Brasil and Germany. The Angra Nuclear Center will be, according to the officials of Angra 1, more than a resort to a new source for producing electricity; it will be the beginning of a practically original industrial mentality.

Over the splendid bay of Itaorna, the sun that summer afternoon outlines the profile of the five buildings of the Angra 1 powerplant against the backdrop of the Bocaina mountains. The American technicians who we met on the road to the Pousada do Bosque inn, stop for a moment and confess being dazzled by so much beauty. Further down below, the small village of Mambucaba is preparing for sleep by the light of lamps, because even though near to the first Brazilian nuclear powerplant, that town scattered along the edge of the Rio-Santos Highway does not yet have electricity. The contrast is magnificent. In a rough bar near the inn, a former worker at Angra 1 who worked at the project during the first excavation as project foreman, expresses a sort of advanced nostalgia toward a future which is going to be characterized by progress and its inevitable expansion of security. For him Angra Bay is a raw gem which is seeing its last years of sweet tranquility. But he recognizes that a progress with safeguards for the country is preferrable to that sweet tranquility in discomfort and poverty.

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BRAZIL

ABDIB CRITICIZES NUCLEP; SLOWDOWN OF NUCLEAR PROGRAM URGED

Rio de Janeiro JORNAL DO BRASIL in Portuguese 15 Mar 81 p 30

[Report by Milton F. da Rocha Filho]

[Text] Sao Paulo--A study prepared by the Brazilian Association for the Development of Basic Industry (ABDIB) shows that the NUCLEBRAS Heavy Equipment Corporation (NUCLEP) "did not add anything new to the national capital assets industrial park." The study was not made public by ABDIB, which is seeking to maintain good relations with NUCLEP with which it maintains a joint task force.

Sao Paulo industrialist Giordano Romi declared that "national private industry is fully equipped to take care of market requirements. The entry of NUCLEP into areas that private enterprise can take care of adequately is inadmissible." The president of the Brazilian Association of Machine Industries (ABIMAQ), Einar Kok, considers it necessary for NUCLEP "to stay out of the fields served by the private sector."

Complete Idleness

The management of NUCLEP has already sponsored the visit of capital goods industrialists to Itaguai, in Rio de Janeiro, where its factory is installed. That factory, which cost an investment of $300 million is now in its fifth month of complete idleness because it has not received any orders since it was inaugurated in October of last year.

During those visits, however, the industrialists were alarmed at what they saw: "A huge installed capacity without anything to do, at least for the time being." The hope expressed by NUCLEP officials to the industrialists was that the new factory might receive orders for the export of nuclear equipment. For the time being, there is only hope.

In NUCLEP's industrial park, the industrialists discovered: a deep borer, three pipe-welding units and three induction-annealing units, which do not exist in other capital goods companies, in addition to two sets of vacuum pumps that may be used under subcontract.

NUCLEP's delay in going into operation is attributed, among other reasons, to the delay in the release by the Bank of Brazil Foreign Trade Department (CACEX) of equipment it imported, such as the welding equipment. The company should have been operating since November 1979. That NUCLEP factory is the largest of its kind in the world and will employ 1,380 workers when it is working at full capacity. The estimate of its production made by the Brazilian Nuclear Corporation (NUCLEBRAS) itself was $380 million worth of equipment annually.

Distrust

The industrialists of the capital goods sector do not sleep peacefully, especially those who operate large firms such as Villares, Bardella, Cobrasma or Confab Industrial. They believe that the entry of NUCLEP into their areas of operation is imminent, competing with those companies directly for the capital goods market orders.

The list of NUCLEP equipment is part of a 30-typewritten page report containing their specifications. That report begins by citing the center of the firm's machine-tools, with a 300-ton lathe, a mandrel [milling] machines, a 300-ton lathe and a 100-ton vertical lathe. The report gives details, machine by machine. That study was received by the industrialists who visited Itaguai last year.

The industrialists are watchful for any move by NUCLEP and recall the example of USIMEC [expansion unknown], which offers below market prices. As for the complaints to the National Economic Development Bank (BNDE) which controls it, its president, Luiz Sande, says that "USIMEC is fighting for survival."

Industrialists Support Slowdown

"The Brazilian-German nuclear program has been slowed down. Only someone who does not want to see it cannot see it," stressed industrialists who support the continuation of that commitment by the authorities. "There are other priorities," stressed the president of the Brazilian Association for the Development of Basic Industry (ABDIB), Waldir Gianetti.

The president of the Brazilian Association of Machine Industries (ABIMAQ), Einar Kok, also supports the slowdown of the program as a means of applying the meager resources which the country has to programs that will offer a quick return and that are considered priority. In general, the industrialists support the completion of the Angra-I and II plants and later, the establishment of Angra-III at a slow pace, observing the transfer of technology.

Another industrialist with a definite opinion on the Brazilian nuclear program is Claudio Bardella who, despite being an interested party inasmuch as his firm was chosen to supply equipment, believes that a slowdown of the program is more beneficial for the country in the present circumstances. "We can complete the plants that have already been begun and proceed at a slower pace with the others," he said.

There is a consensus among the industrialists with regard to the nuclear program but neither the government nor NUCLEBRAS will ever express themselves in favor of a slowdown. That is so, despite the fact that in practice there has already been a delay of 3 and a half years in the original timetable to install the eight nuclear plants in the country. They believe that the visit Delfim Netto will make to Germany next May may reactivate at least the part pertaining to the influx of dollars to Brazil. There is a concentrated effort on the part of Kraftwerk Union (KWU) to accelerate the program. It will provide a good part of the equipment and technology for Angra-II.

In Sao Paulo, the nuclear program is discussed most in the basic industry sector. The government area supports the installation of at least two nuclear plants on the southern coast of Sao Paulo because it alleges that hydraulic resources for power generation are already exhausted in that state and the solution for the year 2000 is the nuclear plant.

Another sector supports the utilization of the energy of the rivers in the northern part of the country through the use of large direct-current transmission lines like those being installed between Itaipu Plant, in Foz do Iguacu in Parana, up to Sao Paulo. With the creation of NUCLEBRAS Construction Corporation (NUCON), the studies of the Sao Paulo Power Company (CESP) the installation of two nuclear plants on the southern coast have been paralyzed. The next step by NUCLEBRAS, which has already expropriated areas in the southern coast, in Iguape, is being awaited.

The biggest critic of the Brazilian nuclear program and one who has conducted a number of technical studies in that regard, industrialist Antonio Ermirio de Moraes, is of the opinion that its delay is the best thing for the country. "We can undertake the development of national technology and thereby save foreign exchange. Furthermore, today we are buying superseded technology," he declared.

He conducted a study for the JORNAL DO BRASIL in which he points out that in first reactor installed (Westinghouse) in Angra-1, Brazilian industry supplied practically nothing (8 percent). "And we received a black box without any technological benefit for the country. At the time of the purchase of the German reactors, national industry was in a position to supply 61 percent between 1975 and 1977 and 66 to 70 percent between 1980 and 1982. It was said then that four reactors would be built in Germany and four in Brazil. We built the factory (today useless) and it remains empty (namely, NUCLEP). For the first two reactors, national industry received 10 percent of the orders. We again bought a black box and made a very bad deal. It is said that we will only get the technology if we actually buy eight reactors. The reactor is Westinghouse technology. How many did Germany buy to get the technology?" asked the industrialist.

He concluded that the "nuclear program is disastrous for Brazil because:

"1) It is not necessary; 2) a nuclear plant requires initial investments three times greater than for a hydroelectric plant; 3) A nuclear kilowatt costs 3.6 times more than a hydroelectric kilowatt. Angra-1 in operation will mean a great financial loss annually because of the greater cost of generation. Angra-2 will mean a greater loss, amounting to $275 million annually. In Angra-II we are going to invest 1,245 million kilowatts times $2,400 each, which means almost $3 billion and an annual loss of $275 million.

"In the eight nuclear plants they are threatening to build, we are going to invest $24 billion and lose $2.2 billion annually. That is impossible. Something has to be done urgently."
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CSO: 5100/2214

BRAZIL

BRIEFS

POSSIBLE ACCORD WITH GREAT BRITAIN--London--Mines and Energy Minister Cesar Cals had a long meeting yesterday in the British Atomic Energy Agency, where the director of the technical unit of the foreign projects group, O. Plail, showed him the projects under development and the possibilities of the participation of Brazil in programs in the nuclear area. Among the programs developed in England together with other countries is the Joint European Torus (JET), aimed at the use and control of thermonuclear fusion technology. Although the minister denied any immediate interest by Brazil in the program for the generation of energy by nuclear fusion, he nevertheless admitted the possibility of negotiations also in that area, observing that at this moment "we are interested in developing projects related to plasma technology." According to the minister, the British are interested in intensifying technological and trade exchange relations with Brazil and this opens up broad prospects. Another possibility open in that area is the participation of the British in implementing the current Brazilian nuclear program, also supplying technology. It is a form of services that could help counterbalance the trade balance deficit, which is favorable to Brazil by more than $70 million. [Brasilia CORREIO BRAZILIENSE in Portuguese 20 Mar 81 p 5] 8711

EURODIF MAY SUPPLY ENRICHED URANIUM--Paris--If Urenco does not supply Brazil the enriched uranium necessary for the operation of its first reactors, the European Corporation for Uranium Enrichment by Gaseous Diffusion (EURODIF) may do so. Its production is theoretically sold up to 1990 but the delay or abandonment of nuclear programs of some of its stockholders (Italy and Iran) make part of its fuel available. EURODIF even has a very concrete proposal to make to Brazil: to become one of its suppliers of enriched uranium when the Brazilian plant promised by Germany goes into operation. The proposal was to have been made during a visit by President Figueiredo to the EURODIF nuclear power plants when he was in France. The visit did not take place for as yet unexplained reasons. It is true that officially Brazil has no reason to be interested in the deal: its needs will be covered by the Americans for the start of Angra-I and then by Urenco for the other plants. But the Dutch partners of Urenco oppose supplying enriched uranium to Brazil and since the unanimity of the stockholders is necessary, the problem may remain. EURODIF's business managers want the Brazilian Electric Power Corporation (ELETROBRAS) to become one of its customers. But they would find it even better for Brazil to become one of the future shareholders of COREDIF in 1990. COREDIF will be an industrial corporation for the production of enriched uranium, like EURODIF. Its basic stockhoders--EURODIF's stockholders--may be joined by new stockholders and Brazil could be one of them. [Rio do Janeiro JORNAL DO BRASIL in Portuguese 13 Mar 81 p 17] 8711

CALS ON ACCORD WITH FRANCE--Mines and Energy Minister Cesar Cals believes that $30 billion more must be invested in the nuclear program, even to obtain superseded technology in the year 2000. And he has plans to sign an agreement this year for the transfer of super-regenerator reactor technology, possibly with France, which has the most advanced knowledge in that area. "The country's concern is not only with its foreign debt but with the balance of payments. For that purpose, we will always have to generate foreign exchange to pay the service on the debt," he said during the Radio Jornal do Brasil debate. [Rio de Janeiro JORNAL DO BRASIL in Portuguese 14 Mar 81 p 19] 8711

URANIUM PROSPECTING SLOWDOWN--Brasilia--The Brazilian Nuclear Corporation (NUCLEBRAS) is no longer prospecting for uranium inasmuch as current reserves (236,000 tons) are enough to take care of the demand of 40 reactors the size of Angra-II (1,245 megawatts) for their whole useful life (30 years). Since Brazilian uranium reserves are already large in relation to the needs of the nuclear program, NUCLEBRAS is concentrating its resources in investigating the areas already discovered with a view to arriving at a more exact definition ot existing reserves. That information was supplied by a Mines and Energy Ministry source, who said that those reserves will not change much in the next few years in view of the advisability of diverting resources to other more important work instead of exploring new areas with an incidence of uranium. According to the same source, there are thousands of indications of uranium in the country but NUCLEBRAS is going to concentrate its activities in the already known reserves, especially in Pocos de Caldas, where a volume of 150,000 tons per month is already being produced and beneficiated, and in Itataia, in Ceara, where a uranium mining and benefication project is going to be installed. [Sao Paulo FOLHA DE SAO PAULO in Portuguese 18 Mar 81 p 21] 8711

NUCLEBRAS EXPLAINS EXPROPRIATIONS--The president of NUCLEBRAS, Paulo Nogueira Batista, sent a letter to the mayors and chairmen of the municipal councils of the San Paulo municipalities of Peruibe and Iguape providing explanations about the process of land expropriation on the Sao Paulo coast between the two cities for construction of two nuclear plants. In the letter, he seeks to calm the population of the area to be expropriated, assuring them that NUCLEBRAS will negotiate with the Land Reform and Settlement Institute (INCRA) so that the landholders who are dislodged may be moved to available public areas in the same region. The letter says also that the work for installation of the two plants is in the initial phase of site engineering, comprising geological, seismological and hydrological studies. Only after the studies have been completed by the end of the year will the area needed for construction of the two plants be selected. And only after that selection will NUCLEBRAS think about the expropriation actions in the probable "area of exclusion" (area that cannot be inhabited) of the two plants. The president of NUCLEBRAS also promised the population of Peruibe and Iguape that the company will give preference to local manpower and whenever possible will utilize the infrastructure of urban services available in the region. At its maximum point the work may absorb about

6,000 persons, the majority of them workers. [Rio de Janeiro JORNAL DO BRASIL in Portuguese 14 Mar 81 p 19] 8711

FURNAS TRANSFERS PROJECT TO NUCON--The protocol transferring the Angra-II and III nuclear plant projects to the NUCLEBRAS Construction Corporation (NUCON) will be signed on 27 March in the office of the minister of mines and energy in Rio, the president of ELETROBRAS, General Costa Cavalcanti, reported. The document, which, according to General Costa Cavalcanti, "is almost ready," defines which of the contracts signed by Furnas for execution of the work on the two projects will be transferred to NUCON and which will remain with Furnas. The contracts with Norberto Odebrecht Construction for the civil works and with KWU for supplying the equipment will be held by NUCON. Other items that will be defined in the protocol are the question of training the future operators of the nuclear power plants (Furnas will operate the plants) and the division of the project bed since the Angra-I plant which belongs to Furnas and is included in the transfer to NUCON is in the same locale. After signing the protocol, Furnas and NUCON will study the terms of the overall contract for construction of the plants, which will have to be signed by 31 July, according to President Figueiredo's instructions. [Rio de Janeiro JORNAL DO BRASIL in Portuguese 17 Mar 81 p 19] 8711

CSO: 5100/2214

BRIEFS

NUCLEAR POWER STATION SITE CHANGED--Cairo, 18 Apr (MENA)--AL-AHRAM reports today that an important amendment has been introduced regarding the sites of the nuclear power stations to be constructed in Egypt and that it has been decided to finally sign the nuclear cooperation agreement with the United States in Washington around the end of May. Electricity Minister Eng Mahir Abazan told AL-AHRAM that the ad-Dab'ah area on the northern coast has been chosen as a site instead of the (Sid Krir) area for the construction of the two nuclear power stations that will be bought from France. He added that the az-Za'farani areas has been chosen as a site for the construction of the two nuclear power stations to be bought from the United States. [Text] [NC180838 Cairo MENA in Arabic 0620 GMT 18 Apr 81]

CSO: 5100/4731

USSR

CEMA ROLE IN PROMOTING NUCLEAR SCIENCE, TECHNOLOGY IN CUBA

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 5, 1980 pp 15-19

[Article by Fidel A. Castro Dias, Director of the Executive Secretariat for Nuclear Questions of the Council of Ministers of the Republic of Cuba, Head of the Delegation of the Republic of Cuba to the Permanent Commission of the CEMA on the Utilization of Nuclear Power for Peaceful Purposes]

[Text]

I

No nation with meager natural energy resources is capable of achieving harmonious development without having a reliable energy base. For this reason, great efforts are being made in the world at the present time to develop alternative sources of energy, which make it possible to utilize solar, geothermal, biomass and thermonuclear energy, as well as other sources which would be able to meet the rising energy demands of mankind till the end of our century. However, the level of the technological development of these sources does not allow for their utilization in the resolution of energy problems confronting such nations as Cuba, which do not have their own oil or other classical energy sources.

TABLE 1.

The Growth Dynamics of the Installed Capacity of the National Electrical Power System of the Republic of Cuba During 1970-1980

Year	Installed Capacity of the National Electrical Power System, MW
1970	908.0
1975	1,202.9
1978	1,664.1
1980	2,102.1

The degree of difficulty involved in satisfying our demands for energy by traditional means is eloquently attested by the data cited in Table 1. It can be seen from the data that the installed capacity of the national electrical power system (NES) increased by a factor of 2.3 over a period of 10 years in our nation (1970 to 1980), and nonetheless, it is inadequate. If one considers the fact that a large quantity of oil which is almost completely imported is used to generate electrical power in such a volume, and the prices for this kind of fuel at present and in the future are taken into account, as well as the cost of transportation, it then becomes obvious why the utilization of nuclear electric power stations has been taken as the basis for electrical power engineering development in our nation as the sole nontraditional technology which has been developed at the present time to a sufficient extent for the needs of the expanding national economy.

However, it is necessary to note the scientific and technical mastery of nuclear power engineering presents considerable difficulties and also requires the corresponding scientific research phase as well as highly skilled personnel; for this reason, considering international experience and the special conditions of our nation, four major areas should be treated in the resolution of this problem:

--The construction, start-up and operation of nuclear electric power stations;

--Basic and applied research, primarily that which promotes the mastery of nuclear power engineering;

--The widescale application of nuclear technology in various sectors of the national economy and science, particularly in those which are of special economic and social significance in Cuba;

--The preparation and special training of personnel with intermediate and advanced education in national organizations and in the organizations of the CEMA member nations for the above indicated fields.

It is apparent that to carry out these tasks for a nation such as Cuba where there are no scientific and engineering traditions which is applying all of its efforts to overcoming its underdeveloped status is not an easy matter. The inherent necessity of strong ties of international cooperation follows from this, primarily with the remaining CEMA member nations. Because of this, it can be asserted that the short history of nuclear science and engineering in Cuba is a history of cooperation with the Soviet Union and other socialist nations, while the future development of nuclear science and engineering in our nation depends to a large extent on the scope of international cooperation, on that assistance which will be rendered to our nation.

II

Work in the field of nuclear power is being done by various departments, institutions and scientific research centers in our nation.

Thus, over the course of a few years, specialists of the Ministry of Major Industry have been working with the cooperation of Soviet specialists on the preparation for the construction of the first Cuban nuclear electric power station at Juragua.

About 20 national departments and institutions have participated in the capital investments program; in this case, a considerable volume of engineering geology and other research was done to select the site for the AES and this work was completed in 1979. The engineering project plan is being developed at the present time and research is underway on the facilities incorporated in the general plan of the station.

On the other hand, work is underway in the nation's various scientific research institutions on the creation of the fundamentals for the development of nuclear science and engineering. The most important of such institutions is the Institute of Nuclear Research (IYaI) of the Academy of Sciences of the Republic of Cuba previously the Institute of Nuclear Physics, created in 1969 based on the equipment given to our country free of charge by the Soviet Union.

Work has been underway right since the creation of the institute in such fields as reactor science and engineering as well as nuclear instrument making, radio chemistry, dosimetry and radiation safety. Of the specific research in the fields of physics and nuclear reactor design, one can point to such work as the execution of a cycle of measurements to determine the parameters of a water moderated subcritical uranium pile, the determination of the thermal neutron utilization factor and the influence of boron content on the system characteristics, where this work has led to interesting results. A special program containing a mathematical model which makes it possible to compare the theoretical conclusions with the experimental data was developed to process the experimental results.

Work is underway on the design of algorithms for thermophysical and thermohydraulic calculations, as well as for the overall design of the shielding for VVER [water-moderated, water-cooled power reactor] type reactors in one and two group approximations. A graphite subcritical pile was designed and assembled.

The participation of Cuban specialists in the activity of the Provisional International Scientific Research Collective (VMK) in Budapest played a very important part in the performance of this work for the conduct of joint studies on a VVER type critical pile. Cuba has been a member of this collective since 1976, and at the present time, a group of specialists is performing scientific research and other works on the physics and design of nuclear reactors in the VMK.

The Institute of Nuclear Research likewise has an activation analysis laboratory, which is equipped with a neutron generator, which will start work in the immediate future on the determination of the content of various elements in the lateritic ores of the eastern portion of the country.

It is planned that in the not too distant future the Institute of Nuclear Research will be transformed into a scientific research center equipped with equipment which is unique to our country. The major tasks of the center are:

--Assisting in the development of nuclear power engineering in the nation;

--The performance of research which is commensurate with the nation's capabilities in the field of nuclear physics, solid state physics and radio chemistry, something which will simultaneously promote an improvement in the state of the art of science in Cuba in these fields;

--Assisting in the introduction of nuclear technology in the national economy;

--Expanding the production of isotopes and tagged compounds in accordance with the nation's needs;

--Assisting in the training of personnel in various specialties of nuclear science and engineering;

--The performance of research in the field of radioactive contamination of the environment, dosimetry, radiation and nuclear safety.

A provision is being made at the Institute of Nuclear Research for the Organization of a Central Laboratory for the Study of the Radioactive Contamination of the Environment, which will service both the center itself and the nation's other nuclear facilities as well as carry out research in the given field.

There are also other institutions in the country working on the application of nuclear technology to the national economy. The National Center for Scientific Research (NTsNI) can be numbered among them, in one of the departments of which work is underway in the field of the radiation treatment of food products and the application of nuclear technology to various technological processes. A test stand using a Co-60 source to irradiate potatoes will be installed here in the immediate future; the installation is being acquired in the USSR using MAGATE [International Atomic Energy Agency (IAEA)] funds and is being installed with assistance of Soviet specialists. A department of nuclear medicine has been operating since 1963 in the Institute of Oncology and Radiobiology (IOR) of the Ministry of Public Health. Here, radio-isotope techniques are being used successfully in the diagnosis and treatment of malignant tumors. Personnel have been trained by the specialists of the Institute of Oncology and Radiobiology for other institutes of the Ministry of Public Health and now departments of nuclear medicine are also functioning in these institutes.

The school to advance the education of specialists in the field of nuclear medicine, which was organized in accordance with the plan of the CEMA Permanent Commission on the Utilization of Nuclear Power for Peaceful Purposes, and which was held in Havana in October of 1977 was of great importance. Specialists from the CEMA member nations and the nations of Latin America, as well as IAEA lecturers participated in the work of the school.

No small amount of attention is being devoted to the training of personnel in the country. In 1976, the Ministry of Higher Education introduced the specialty of "nuclear power engineering" with specialization in nuclear power stations in the Higher Polytechnical Institute imeni Jose Antonio Echeverria (VPIKhAE). The assistance received by the VPIKhAE played an important part in the preparation of the plans and programs for the specialty, especially that from the Moscow Power Engineering Institute.

A group of physicists receiving specific training in the field of nuclear physics is being prepared in the University of Havana. At the present time, the necessity for introducing other specialties in the field of nuclear science and engineering in the nation is also being studied.

It is important to note that a significant number of the specialists with higher education, who are working today in the field of nuclear science and engineering, are graduates of the higher educational institutions of the USSR and other socialist nations. Many Cubans are today studying in the USSR in the advanced school, mastering the specialties in the field of nuclear science and engineering. It is planned that an appropriate number of young Cubans will be sent annually for training not only in the USSR, but also the teaching institutions of the Bulgarian Peoples Republic, Hungarian Peoples Republic, GDR and Czechoslovakian SSR. Work has begun in the latest classes of the intermediate school on the preparation and selection of candidates for such training among the most promising students.

To provide for the training of the engineering personnel and qualified workers, the construction of a technical school for 500 students has been started not far from the nuclear electric power station Juragua. The technical school can also be used to improve the skills of some of the operational personnel of the station itself at Juragua and other stations which will appear in the nation in the future.

III

A very important question which should be considered when analyzing the capabilities of Cuba in the comprehensive development of nuclear power and engineering is international cooperation in this field. The training of specialists at a high scientific level in the educational institutions of other nations and the creation of the material base necessary to equip the nation's major nuclear plants take on special significance here. To be mentioned first of all in this regard is the entry of Cuba in 1976 into the Joint Nuclear Research Institute at Dubna and the participation of Cuban specialists in individual efforts of the Central Nuclear Research Institute at Rossendorf in the GDR, which along with the previously mentioned work in the VNR, was an important landmark in the development of our participation in the cooperation of socialist nations in the field of nuclear science and engineering. A small group of Cuban specialists, working at the present time in the Joint Nuclear Research Institute (OIYaI) is faced with the task of maximum utilization of the unique capabilities of the center for training personnel and doing that work, which by virtue of its cost and requisite equipment volume can be performed in our country.

Up to now, an important way for equipment to come into the country is the financing of technical assistance projects through IAEA and the Developmental Program of the United Stations Organization (PROON).

The PROON plan through which the laboratories of the Institute of Nuclear Research, the National Center for Scientific Research, the Institute of Oncology and Radiobiology and three higher institutions of learning: University of Havana, the Higher Polytechical Institute (VPIKhAE) and the University of Oriente, will be outfitted with equipment is in the implementation stage.

TABLE 2

The Equipment Provided by Subprogram 12 for the Accelerated Development of Nuclear Science and Engineering in the Republic of Cuba

Organization	Equipment
A. Institute of Nuclear Research	The zero power reactor Shops for the small-scale series production and repair of nuclear equipment The complex for the production of isotopes and tagged compounds Various laboratories: dosimetry and radiation safety, chemical, radiochemical, radiometric, metrological, etc. Facilities for work related to the observation of the environment.
B. Other organizations	
The Higher Polytechnical Institute	Training laboratories for nuclear electric power station technology
The Ministry of Public Health	Facilities for the application of radiation technology to biomedicine Facilities to provide for radiation safety of medical institutions and perform medical examinations of persons working with radioactive substances.
The Higher Institute of the Agricultural Sciences	Laboratory for the application of radiation technology to agriculture
The National Scientific Research Center	Laboratory for the application of radiation technology to industry

Accords or protocols have been signed within the framework of bilateral cooperation with departments working on questions of atomic energy in the USSR, the GDR, the Hungarian Peoples Republic and the Czechoslovakian SSR. Cuban specialists have undergone special training and have received technical assistance in line with accords concluded between the Academy of Sciences and agreements between the Ministry of Major Industry and the appropriate ministries of the community of socialist nations.

The participation of Cuban specialists in the activity of CEMA organs, working in the field of nuclear science and engineering - the CEMA Permanent Commission on the Utilization of Nuclear Power for Peaceful Purposes and the CEMA Permanent Commission on Electrical Power (Section V) - signified the start of a path of fruitful cooperation, and also opened up the possibility for obtaining valuable information.

The decree of the 30th meeting of the CEMA session, which extended to the Republic of Cuba the basic stipulations of the Comprehensive Program for the Further Strengthening and Improvement of Cooperation and Development of Socialist Economic Integration of CEMA Member Nations, adopted earlier for the Mongolian People's Republic, was of great importance for us, since this decree makes it possible to develop special measures to bring the levels of development of our country closer to the developmental levels of other member nations of the CEMA. The indicated program provides for the following measures, along with others:

--The joint construction and operation of industrial facilities by means of the participation of financial, material and technical support, as well as the work force;

--Rendering assistance in the completion of the planned capacities and achieving the technical and economic indicators for the operation of enterprises provided in the relevant project plans, where these enterprises were built with the cooperation of CEMA member nations;

--Preferential treatment in providing various credits;

--The application of incentive prices;

--Rendering effective assistance in the development of science and the training of Cuban specialists;

--Rendering assistance free of charge in cases which are agreed upon.

Based on the indicated decree, a plan for the accelerated development of science and engineering in the Republic of Cuba, a constituent part of which is Subprogram II (Nuclear Power), was developed and adopted by a session of the council.

The realization of the Subprogram, the major contents of which are shown in Table 2, will undoubtedly be an important step in the creation of the material and technical base necessary for the execution of the tasks related to the scientific and engineering support of the nuclear power engineering development of the nation, the modernization of the Institute of Nuclear Research and the training of personnel for the given sector.

Thus, the equipment which will be available to the Institute of Nuclear Research during 1981 - 1985 as presently planned will either be almost completely incorporated in the Subprogram or in bilateral agreements which provide for financing conditions favorable to Cuba. Cuba is interested in seeing that the execution of the terms of the Subprogram related to the modernization of the nuclear center be started as soon as possible.

IV

The five-year period from 1981 to 1985 will be of special significance for nuclear science and engineering in Cuba, since the first Cuban AES will be built and the Institute of Nuclear Research will be modernized during this time.

This is why our participation in the work of the CEMA organs indicated above should be concentrated on tasks directly related to the development of the nuclear base of the Institute of Nuclear Research and the research necessary for the utilization of the planned capital investments, as well as the training of national staffs for the start and operation of the Institute of Nuclear Research and AES installations.

In this regard, the participation of two Cuban organizations - the Ministry of Major Industry and the Academy of Sciences (IYaI) - is planned in seven subject areas of the program for CEMA member nation cooperation on the problem of "The Mastery of Power Units with Water-Moderated, Water-Cooled Reactors with a Capacity on the Order of 1,000 MW (electrical) and the Further Refinement of Reactors of This Type" included in the DTsPS to meet the economically substantiated needs of CEMA member nations for the major kinds of energy, fuel and raw materials.

The installation of the zero power reactor in the nation in the next five-year plan, which is provided by Subprogram 12, as well as the outfitting with the corresponding computer equipment will undoubtedly make it possible to expand Cuba's participation in the given program.

The construction process itself for the first AES will confront Cuban specialists with new problems, which can be solved only in close cooperation with the USSR and other CEMA member nations.

Cooperation with CEMA member nations will be extremely fruitful in solving problems planned for the immediate future, such as that indicated in Subprogram 12: a study of the radiological status of the nation and adjacent waters, which should be carried out in the first years of the 1981-1985 Five-Year Plan.

At the present time, considering the sources of raw material present in the nation, which make it possible to specialize in the production of individual kinds of tagged compounds, we are studying the real possibilities for linking Cuba to the Agreement on Multilateral International Specialization and Cooperation in the Production of Isotope Products. Questions of producing individual radiopharmaceutical preparates and sets for radio-immunological analysis (RIA), for which other CEMA member nations do not have the raw materials, are being studied in this regard. The following kinds of raw materials can be cited here:

--Corals, from which prostaglandin is extracted; this substance is tagged with C-14, H-3 and I-125 and used in the preparation of RIA sets;

--The water remaining after washing jute; [hecogenin] is extracted from it, which is also used in preparing compounds tagged with C-14 and H-3;

--Sugar cane oil; esteroids (esteroidal hormones) are extracted from it, which are tagged with C-14 and H-3. The hormone tagged with I-125 is used in preparing RIA sets.

On the other hand, strengthened ties with the "Interatomenergo" and "Interatominstrument" international economic organizations of the CEMA member nations will have a fruitful influence on the development of the corresponding sectors in our nation.

Our participation in work performed within the CEMA framework, which is directed towards exchanging experience in the construction and operation of AES's is also important. Cuban specialists could be sent to CEMA member nations during various stages of the construction and installation of AES's.

The 35th Session of the Permanent Commission of the CEMA on the Utilization of Atomic Energy for Peaceful Purposes which was held in Cuba in November of 1978, as well as the meeting of one of the working organs of the commission on the topic "Radiation Safety" were of great importance for us.

V

The periods of 1981-1985 and 1986-1990 will be extraordinarily important for the development of nuclear science and engineering in Cuba, since the nation's first nuclear electric power station will be constructed and go on-line, and measures will be taken to modernize the Institute of Nuclear Research.

The development and mastery of nuclear power engineering, and the capabilities of using nuclear technology which derive from this are of great significance in assuring the future development of our nation.

We are confronted by a large and complex task. It is apparent that to carry it out, Cuba will be in greater need of international cooperation and technical assistance, primarily from other CEMA member nations, which have already demonstrated their constant readiness to render assistance to our country in this field, as well as in other areas.

For its part, Cuba will now and in the future strengthen its ties of fraternal cooperation in the mastery of nuclear science and engineering, recognizing that the peaceful utilization of atomic energy will bring great good to our peoples.

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8225
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FEDERAL REPUBLIC OF GERMANY

CONCERN OVER REACTORS ON FRENCH, GDR BORDERS

Bonn DIE WELT in German 3/4 Jan 81 Supplement p IV

[Article by Egmont R. Koch: Risks Are Not Contained Within Borders]

[Text] For years environmental protectionists and citizens' initiatives in Baden have been trying to make better preparations should a nuclear catastrophe occur. Their argument is this: If, on the other side of the German-French Rhine border, a nuclear accident occurs in the nuclear plant in Fessenheim and the nuclear fallout moves east, this would cause chaos after a nuclear emergency is proclaimed on the territory of the Federal German Republic because of inadequate planning for emergency measures. This concern cannot be easily met with valid arguments. Indeed, we are even less well prepared for imported nuclear dangers than for nuclear accidents in general. This is true even more in the east of our country than in the west.

For in the GDR safety rules for nuclear power plants are even less strict than the rules in France. The Soviet Union's nuclear reactors type, "Novovoronezh 440," for instance, are constructed in a way that no Western country would issue a permit for their operation. They have no containment which envelopes the reactor like a cheese dish cover, thus in an emergency preventing the escape of radioactive particles. They have no emergency cooling system, which could prevent dangerous overheating and melting of the fuel rods, should the primary cooling system break down.

In other words, the GDR's nuclear reactors are definitely insufficiently prepared for accidents. Realization of this fact is disquieting, because the GDR's nuclear plants also are a threat to the Federal Republic of Germany. Wilhelm Sahl, head of the Department for Nuclear Safety in the Federal Republic's Ministry of the Interior, voices his fear as follows: Even though most of the time the wind blows in the other direction, the condition is not "very comforting."

Imagine the case of an emergency: In the nuclear plant in Lubmin, Rostock Bezirk, a 10 cm pipe of the cooling system bursts. The plant has no containment and is protected neither against earthquakes nor the crashes of even small airplanes. The emergency cooling system for such cases, a sprinkler system, is only a drop on the hot "stone," which on the inside of the reactor is getting increasingly hotter. Within a few hours the fuel rods dry out and start to melt. The hot nuclear "lava" eats through the foundation and eventually finds its way into the ground water. The worst conceivable nuclear accident has just occurred. All of the fission material has escaped into the environment. A strong east wind blows the radioactive cloud towards the west. The radioactive fallout occurs in the Bay of Luebeck. The radioactive particles come down as precipitation, thus causing an imported nuclear disaster. We will be completely unsuspecting, since it can hardly be expected that the GDR will announce the disaster in time.

Nevertheless, in Luebeck an atomic biological and chemical warfare squad of the civil defense unit is on alert. Although the squad has been prepared for nuclear disasters during wartime, it will of course be ready to act in times of peace. It has the following tasks: measurement of the radioactive radiation and decontamination.

Should the radioactive cloud move toward the south though, Germany would be in trouble. Nuclear protection is almost nonexistent in the Lueneburger Heide. The rural districts of Gifhorn, Celle, Uelzen, Luechow-Dannenberg, Lueneburg and Harburg have no civil defense units. The nearest civil defense units are located in Hamburg.

We are completely in the dark about the warning methods to be used for the rural population. In the emergency plans for the surrounding nuclear plants it has been considered to use a 1-minute sounding of sirens as a signal to turn on the radio, but hardly anybody is informed about the significance of the signal.

Even if it were possible to inform the population of the endangered region by a house-by-house, farm-by-farm method, the success of evacuation procedures is questionable, because at this point no detailed plans exist for the endangered regions along the border.

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PROBLEMS IN DEVELOPING HIGH TEMPERATURE REACTORS

Bonn RHEINISCHER MERKUR/CHRIST UND WELT in German 16 Jan 81 p 15

[Article by Michael Globig: "Money Source Runs Dry"]

[Text] The development of the high-temperature reactor, furthered by public funds for the last 20 years--North Rhine-Westphalian and federal funds have amounted to more than DM2 billion--can, in the opinion of the FRG Government, play a part in the future energy supply. But whether it will actually play this role definitely depends on the participation of the interested economic branches. With these words Erwin Stahl, parliamentary State Secretary in the Federal Ministry for Research, sketched the ministry's new policy toward the construction of this advanced line of reactors. Stahl's superior, Minister Andreas von Buelow, indicated shortly after taking office in November last year that he would try to commit the energy supply companies to contribute a larger share of the development and construction costs not only of the high-temperature reactor, but also of the fast breeder reactor.

Politicians, unions, employee representatives and journalists were invited by the management council of Brown, Boverie & Cie, the company participating in the construction, to the Center for Nuclear Research in Juelich to a meeting with the purpose of informing the participants of the stage of development and the energy-policy significance of the high temperature reactor. At this meeting State Secretary Stahl indicated that this larger share should relate mainly to the project following the thorium high temperature reactor THTR 300.

For the last 10 years the THTR 300 has been under construction in Schmelhausen on the east border of the Ruhr area and should finally be operational in 1983/84, unless further delays in the processing of the permits occur. By that time the construction time would have doubled and the construction cost (now estimated at 2.4 billion German marks) will be roughly four times as much as the original estimate.

This prototype of a high-temperature reactor (with ball-shaped fuel elements) is to be used only for the generation of electricity and does not utilize the real potential of the new design, the generation of process heat at a high-temperature level (up to 950 degrees Centigrade). The possibility of heat production for industrial users is supposed to be first tested in a later installation. This installation has become known by the name Prototype Reactor for Nuclear Process Heat (PNP). In the meantime the experts have found that this reactor cannot be built immediately as a successor to the THTR, because there are too many unsolved problems with the material. Therefore it is assumed that a PNP will not be built until the end of the eighties.

In the meantime, the big German electricity supply companies (which formed the High Temperature Reactor Association in Hannover a few days ago) as well as Ruhrkohle and Ruhrgas Corporation, plan to build a reactor on the basis of THTR with an electrical output of 900 megawatts. The reactor will produce electricity as well as processing steam of 600 degrees for the gasification of coal. In late March the potential manufacturing companies (Brown, Boverie & Cie and the Kraftwerks Union) will prepare a draft for an installation of this kind. Its feasibility will be tested by the future users up to mid-1981.

If the project proves to be feasible, the Ministry of Research plans to grant financial support, but only in the areas where research and development must still be done. The construction and marketing of the installation, though, would primarily be the responsibility of the industry.

Reimut Jochimsen, North Rhine-Westphalia's minister of economic affairs, views further aid not quite as uncompromisingly: since the land has firmly decided on the high-temperature reactor and has declared that the gasification of coal is economically and environmentally practical only with nuclear processing heat, the land plans further aid to this line of reactors.

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